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ABSTRACT

This study claimed that the ability of bilingual children to solve metalinguistic problems depends upon the demands of a given problem for analysis of knowledge or control of processing. It examined two hypotheses concerning bilingualism and metalinguistic problem-solving: (1) that bilingual children would be more advanced than monolingual children in their level of control of linguistic processing, and (2) bilingual children fully competent in both languages would be more advanced than monolingual or partially bilingual children in their level of analysis of linguistic knowledge. The subjects were 57 first-graders, from three schools in a suburb of Toronto, Canada, at three levels of language proficiency (English monolingual and partially or fluently French-English bilingual) but similar socioeconomic and ability levels. Three tests were administered: a test of the children's knowledge of abstract concepts associated with words, a syntax correction task, and an assessment of understanding of the arbitrary connection between linguistic form and reference in the world. Despite some inconsistencies between the predictions and results, it was concluded that children who differ in their level of bilingualism do enjoy different advantages in solving metalinguistic problems compared to each other and to monolingual children. This finding is at least partly consistent with a description of the processing skill component most involved in the solution to the metalinguistic problem. Implications of these results for the study of the analysis of linguistic knowledge, control of processing, and linguistic awareness are considered. (MSE)

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Metalinguistic Dimensions of Second Language Proficiency

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Metalinguistic Dimensions of Second Language Proficiency

Research investigating the effects of bilingualism on a variety of academic, linguistic, and intellectual achievements has traditionally led to conflicting results. Many of the early studies which warned of disastrous effects of bilingualism on cognitive development (see Darcy, 1963 for review) were later found to lack proper controls, undermining any interpretation of those findings. Later work revealed a more promising intellectual prognosis for bilingual children. Peal and Lambert (1962), for example, showed how careful selection of subjects in the bilingual population could produce evidence of bilingual superiority on some intelligence tests. The relation between bilingualism and intelligence depended on factors such as social class, degree of language proficiency, and type of bilingualism (Cummins, 1976).

A similar debate surrounds the examination of the relation between bilingualism and linguistic awareness. Evidence for a facilitating effect (Ben Zeev, 1977; Cummins, 1978; Ianco-Worrall, 1972), inhibiting effect (Palmer, 1972), and no effect (Rosenblum & Pinker, 1983) of bilingualism have been reported. Some investigators have found effects in both directions when studying different samples of bilingual children (Ben Zeev, 1977; Cummins, 1978). Just as the early research on the intellectual effects of bilingualism failed to account for relevant factors, so too, this problem requires consideration of a wider range of issues. Reconciliation of the diverse findings needs a more detailed examination of the two factors, bilingualism and linguistic awareness. The present claim is that the relation between bilingualism and linguistic awareness must be stated in terms of the degree and type of bilingualism, and the degree and

type of linguistic awareness.

Regarding the definition of bilingualism, two sets of studies have identified *level* of bilingualism as a critical factor in determining the effects of bilingualism on other aspects of development. First, Cummins (1979) proposed the threshold hypothesis as a partial account of inconsistencies in the literature. He argued that those aspects of bilingualism which positively influence cognitive growth are unlikely to emerge until the child has attained a minimum, or threshold level of competence in the second language. By reviewing a large number of studies that reported discrepant findings, he posited a dual-threshold in which the lower level provides the necessary linguistic skill (in either language) to prevent damaging effects on cognition, and the higher level provides the linguistic skill (in both languages) to allow acceleration in cognition.

Second, Hakuta and Diaz (1985) and Diaz (1985) considered the role of relative knowledge of the two languages, or degree of balance. Their study examined differences in a variety of metalinguistic and cognitive tasks for children at different levels of Spanish (L1)/ English (L2) proficiency. The degree of balance was a significant factor in determining performance on these measures. Using causal modelling, their results showed that bilingualism had a greater role in predicting metalinguistic and cognitive performance for children whose language skills were less balanced; in other words, for children in the earlier stages of second language learning.

Level of bilingualism, then, seems decisive in determining the effects that bilingualism will have on other achievements. For Cummins, the relevant factor is absolute levels of L1/L2 proficiency; for Hakuta and Diaz, the relevant factor is relative levels of L1/L2 proficiency. The

first description in absolute terms provides an account of the tasks children should be able to perform; the second description in relative terms provides a statistical description of sources of variance in solving the tasks. Combining these two descriptions, it could be claimed that the cognitive advantages shown by early, or imbalanced, learners in the relative account depend on these learners having at least passed the lower threshold identified by the absolute description. In addition, the kind of task used to measure the cognitive or metalinguistic performance is also relevant in determining the effects of level of bilingualism.

Types of linguistic awareness can be distinguished by considering processing differences involved in different metalinguistic tasks. Our claim, elaborated elsewhere (Bialystok & Ryan, 1985), is that two skill components can be identified as part of the processing requirements for metalinguistic (and other language) tasks and that specific tasks depend differentially on these two components. The two components are analysis of linguistic knowledge and control of linguistic processing.

Analysis of linguistic knowledge is the skill component responsible for the structuring and explication of linguistic knowledge (cf. Bowerman, 1982; Karmiloff-Smith, 1986; Reber & Lewis, 1977). Different uses of language require different levels of explicitness of linguistic knowledge. Some uses, such as conversation, can be supported by unanalysed or implicit representations, but other uses, such as literacy and solving metalinguistic problems, require a more analytic or explicit knowledge of the same linguistic system used implicitly for other purposes (Bereiter & Scardamalia, 1982; Carpenter & Just, 1981). The ability to analyse language in this way, and the knowledge of structure which results from

such analysis, is the skill component analysis of linguistic knowledge. High levels of analysis allow the child to provide definitions and descriptions of language structure (cf. Chomsky, 1979). In information-processing terms, this analysis component corresponds to the memory base which becomes organized into networks, schemata, or systems (crystalized ability).

Control of linguistic processing is the executive component responsible for directing attention to select and integrate information. Different language uses require attention to different aspects of the linguistic input. The usual strategy is to focus on meaning (Hakes, 1980); problems that demand attention to other aspects increase the requirement for control. Learning to read, for example, requires proper sampling and integration of formal (graphemic, syntactic) and semantic (lexical, discursive) information (Lesgold & Perfetti, 1981). Metalinguistic tasks typically require children to focus on forms and sometimes ignore or suppress meaning. The knowledge of procedures for solving a variety of language problems and the ability to execute those solutions through appropriate attentional focus is the function of control of linguistic processing. In information-processing terms, the control component corresponds to executive processes or metacomponents (fluid ability).

Problems are considered metalinguistic if they depend on high levels of one or both of these skill components. Metalinguistic problems differ, however, in which component is most relevant to the solution. Some tasks, for example, awareness of syntax, concept of word, correction problems, definition tasks, paraphrase or judgments of ambiguity depend primarily on the child's knowledge of linguistic structure. The solution to these

problems depends on the child's ability to detect, extract, or articulate some structural property of language. Other tasks, such as the sun-moon problem, sentence segmentation, symbol-substitution, repetition of deviant sentences, depend more on the child's control of attention.[1] In this latter set of problems, the child must carry out a simple task while resisting the meaning of the sentences being manipulated. These tasks generally include misleading cues so that the solution depends on proper selection and integration of information.

The claim in the present study is that the ability of bilingual children to solve metalinguistic problems depends upon the demands of a given problem for analysis of knowledge or control of processing. Moreover, the extent, or degree to which the child is bilingual intervenes to determine which problems may be solved more easily.

Two hypotheses follow from this conceptualization. First, bilingual children should be more advanced than monolingual children in their level of control of linguistic processing. Because bilingual children have the experience of two linguistic systems labelling the same conceptual system, the arbitrary connection between forms and meanings is more readily apparent (Vygotsky, 1934). Moreover, these children have more experience attending to formal linguistic features that may change even though meanings are constant, as in deciding between languages, attending to different phonological systems, and choosing the correct label for an object. In addition, their clearer representation of linguistic and conceptual information as separate structures makes problems involving selective attention to linguistic features less difficult for bilingual children. Hence, problems which require selectively attending to specified

parts of the language, the syntax, the meaning, the phonology, should be easier for bilingual children than for monolingual children of the same age.

Second, bilingual children who are fully competent in both languages should be more advanced than monolingual or partially bilingual children in their level of analysis of linguistic knowledge. The experience of structuring and analysing two linguistic systems should accelerate the extraction of abstract linguistic structures, rules, or concepts. This advantage, however, is confined to children whose knowledge of both languages has been analysed. A second language which remains unanalysed, such as one used only for conversation (and not requiring much analysis of that system), is not expected to yield this advantage. Hence, problems requiring analysed linguistic knowledge should be easier for bilingual children provided that their knowledge of both languages is advanced, possibly balanced, and perhaps includes literacy skills. Children who have only a little knowledge of a second language should not show an advantage over monolingual children when solving metalinguistic problems requiring high levels of analysis of knowledge.

Some evidence for these two predictions has been reported. In a variety of metalinguistic tasks, bilingual children performed better than monolingual children for problems requiring high levels of control but not for problems requiring high levels of analysis of knowledge (Bialystok, 1984). In some cases, however, a bilingual advantage was also obtained for problems requiring analysis of knowledge. In one study, children were asked to count the number of words in sentences under conditions that demanded increasingly explicit knowledge of word boundaries. In addition

to the expected advantage for the bilingual children in the control versions of the problem, there was a weaker, but still reliable advantage in the high analysis versions. These children were both bilingual and biliterate, possessing high levels of skill in both languages (Bialystok, 1986a). Under the present hypothesis, a more detailed definition of the child's level of bilingualism may account for these findings.

The purpose of the present study is to examine these hypotheses for a group of children who differ in their level of bilingualism. It was expected that the bilingual advantage for high control problems would be replicated with a new set of tasks, and that a bilingual advantage for high analysis problems would be evident for children who were fully bilingual.

Method

Subjects

There were 57 children from Grade 1 classes (6 1/2 - 7 year olds) involved in the study. These children included 20 monolingual English-speaking children, 20 partially French-English bilingual children, and 17 fluently French-English bilingual children. The partially bilingual subjects were anglophone children studying in a French immersion programme. These children had been educated entirely in French for almost 2 years at the time of testing and had been formally taught literacy skills only in French. Nonetheless, these children could generally read English as they tend to come from homes in which literacy is emphasized[2]. Their use of French is largely confined to the classroom, usually in interaction with the teacher. The fully bilingual subjects were children who were attending a French school and were therefore educated in French. These children, too, could speak and read English, most likely because they live in middle-

class families in an English-speaking environment. In most cases, these children had one parent who is French, and there was usually some French spoken in the home. Frequently, their early exposure to French was through extended family, such as grandparents. In this school, just as for the French immersion school, the language of the playground is English.

The main feature of the sample is that the children in all three groups were extremely similar in socioeconomic factors. All children were middle to upper middle class. All three schools were located close to each other in suburb of Toronto.

The different language abilities of the groups were empirically verified by administering the Peabody Picture Vocabulary Test (PPVT) as a rough measure of relative language proficiency. All children were given the standardized English version; the two bilingual groups were also given a French translation of the test. For the bilingual groups, the order of French and English tests was randomized, and at least one week separated the administration of the two tests. Different forms of the test were used for the English and French versions, so there was no overlap in the specific vocabulary tested.

Finally, to assure that there were no major IQ differences among the groups, all children were administered the Canadian Test of Cognitive Abilities and the digit span subtest of the WISC. There were no differences found among the children in the three groups.

Tasks

1. Concept of Word.

This task, adapted from Papandropoulou and Sinclair (1974), contained two parts which jointly assessed the child's knowledge of the abstract

concept of a word.

(a) Judge: The child is presented with a list of 10 words and phrases, one at a time, and asked if each one is a word. The list includes concrete objects, numbers, verbs, conjunctions, and phrases. The child is asked to justify each response. [*1 point for correctly identifying all words on the list*]

(b) Define: "What is a word?" "How can you tell if something is a word?". The definitions were scored according to their degree of formality. Three categories were used: formal definition, identifying the properties or uses of words, for example, referring to letters and sounds that have a meaning [*1 point*]; semantic definition, referring to the physical properties of the word's referent or vague formal definition [*1/2 point*]; and no definition, in which the child either did not provide an answer or provided no relevant information [*0 points*].

This task relies on analysed knowledge of the concept of word. The child needs to have a clear idea of the boundaries that are relevant for determining what a word is. Further, the justifications required for part (a) and the definition elicited in part (b) demand an explicit knowledge of those constraints.

These scores, each out of 1, were converted by arcsine transformation[3] yielding scores out of 3.14 for each of the two subparts of the task.

2. Syntax Corrections.

A set of 12 sentences, each containing a grammatical error, was presented to the child orally, one at a time. The child was told to say each sentence the right way after it had been read by the experimenter. [*1 point for each properly corrected sentence*]. The score was the number of

correct repairs produced, to a total of 12.

The task is mostly dependent upon analysis of knowledge to locate and correct grammatical errors. The errors involved verb tense, negation, particle placement, agreement, and word order.

3. Arbitrariness of Language.

This task uses Piaget's (1929) sun-moon problem as it was adapted by Ianco-Worrall (1972) to assess the child's understanding of the arbitrary connection between linguistic form and reference in the world. There were two parts.

(a) Sun/moon: "Suppose you were making up names for things, could you then call the sun 'the moon' and the moon 'the sun'?." Child was persuaded that this was possible. "Now suppose that happened and everybody decided to call the sun 'the moon' and the moon 'the sun'. What would you call the thing in the sky when you go to bed at night? *[I point for sun]* What would the sky look like when you're going to bed?" *[I point for dark]*.

The two scores out of 1 were converted by arcsine transformation to scores out of 3.14 and added together for a total out of 6.28.

(b) "Imagine the names of cats and dogs were changed around. (Child is shown a picture of a cat.) What would this animal's name be? *[I point for 'dog']* What sound would it make?" *[I point for 'meow']*.

The same procedure as that used for the sun/moon problem produced scores out of 6.28 for the dog/cat problem.

The primary demands of this task are on control of processing. The children must ignore their usual experiences with the sun and moon, cats and dogs, in order to manipulate the names for these objects.

Procedures

The three tasks were administered individually in a fixed order. Testing began with the word concept problem, followed by the arbitrariness of language questions, and ended with the syntax correction. All three metalinguistic tasks were administered in English.

Results

Summary data for all measures are presented in Table 1. Regarding language proficiency, there was a difference among the three groups in scores for the PPVT English test, $F(2,54) = 3.53$, $p < .006$. Planned orthogonal comparisons showed the difference to be that the monolingual group scored higher than did the two bilingual groups. The difference between the two bilingual groups on the PPVT French was also significant, $F(1,35) = 60.90$, $p < .001$, the fully bilingual group scoring higher than the partially bilingual group.

Insert Table 1

For the Arbitrariness of Language task, there was a group effect for the sun/moon version of the problem, $F(2,54) = 3.71$, $p < .03$, with the two bilingual groups scoring higher than the monolingual groups. There were no differences among groups for the dog/cat version of the problem.

On the Word Concept task, there was no difference among groups for the Judge problems. The Definitions were scored by two raters and achieved an inter-rater reliability of 0.93. There was a significant difference among groups for this task, $F(2,54) = 4.22$, $p < .01$, with the fully bilingual group scoring better than the monolingual group ($p < .05$) and the partially bilingual group not differing reliably from either of these.

The Syntax task revealed a group effect, $F(2,54) = 7.45$, $p < .001$, in

which the fully bilingual group scored higher than the other two groups.

Discussion

Scores for the two versions of the PPVT confirmed that the groups differed in their language proficiency and degree of bilingualism. The monolingual English group demonstrated the highest level of English competence when measured by a standardized vocabulary test. The two bilingual groups were both slightly less proficient in English than was this monolingual group, but did not differ from each other (cf., Rosenblum & Pinker, 1983). The French scores for these two groups, however, were very different - the fully bilingual group scoring almost twice as high as the partially bilingual group. Where there were group differences in performance, the fully bilingual group always scored the highest and the monolingual group, the lowest. On tasks requiring high levels of control of processing, the partially bilingual group scored about the same as the fully bilingual group; On tasks requiring high levels analysis of knowledge, the partially bilingual group scored about the same as the monolingual group.

The hypothesis concerning performance on tasks demanding high levels of control of processing was that any experience or level of bilingualism would be sufficient to raise the performance of these children above that of their monolingual peers. This was tested with two versions of the sun/moon problem. The predictions were confirmed for the standard version of this problem, but there were no differences among the groups for the altered version that used cats and dogs. There was greater resistance to changing the names of these familiar animals, and the problem seemed not to be treated with the same level of abstraction as was the sun/moon version.

Even for bilingual children, it may be *too* arbitrary to interfere with the relation between certain sounds and such popular animals. Moreoever, the task was more concrete in that the child was looking at a picture of one animal and expected to produce the sound made by the other. Hence, the task was not strictly metalinguistic but included elements of a concept-formation problem.

The hypothesis concerning performance for tasks depending primarily on analysis of knowledge was that the fully bilingual group would be superior to the other two groups. Three tasks of this type were used, and for all three tasks, the fully bilingual group achieved the highest scores. The partially bilingual group, however, did not always behave exactly as the monolingual group. For the word judgment problem, although the ordering of scores for the three groups was consistent with the hypothesis, the differences were not reliable.

The word definition problem was solved best by the fully bilingual children. Their responses indicated the most sophistication and the greatest level of formal knowledge of the concept. Definitions produced by this group included, "words are combinations of letters that mean something," "a sound that always means the same thing," "the name for something that you could read, write, or say." The monolingual children most frequently answered "don't know." The partially bilingual attempted definitions, the most frequent being, "a word is something you can say," or naming different words, or "chair is a word because you can sit on it." The criteria used by the fully bilingual group are not only more advanced in that they are more correct, but also are more general, depending less on specific object features or specific phonological forms.

The third test of analysis of linguistic knowledge was syntax corrections. Here the pattern was as predicted: the fully bilingual group was more successful than were the other two groups. Although the monolingual group demonstrated the highest level of English language proficiency on the PPVT, that advantage was not evident on this more metalinguistic test.

The results for tests of analysis of knowledge were in the predicted direction but included some inconsistencies for the partially bilingual group. One reasons for this may be that analysis of knowledge itself is not a unitary construct but includes the ability to structure of variety of linguistic information. The three aspects of language structure tapped in the three analysis tasks differ in complexity. Judging items to be words is the simplest problem, and all children in the sample could accomplish this to the same level. It is possible that limited experience with literacy is sufficient to bring children to this level of analysis of language. It is also possible that simple judgment tasks do not require high levels of analysis (Bialystok, 1986b), making this problem equally accessible to all children in the sample. Judgment tasks are difficult to interpret in any case, given factors like response biases and a high probability (50%) of correct responding by chance. Analysing the properties that *determine* items to be words is at a higher level, and the monolingual children have not yet analysed the system to this extent. The partially bilingual children appear to have more insight here than do the monolingual children, but are not as sophisticated as the fully bilingual children. Finally, analysis of syntactic structure is the most abstract property of language investigated in these tasks, and only the fully

bilingual children showed an explicit understanding of this aspect of language.

The results show that children who differ in their level of bilingualism enjoy different advantages in solving metalinguistic problems compared to each other and compared to monolingual children. The interpretation of the relevant difference is at least partly consistent with a description of the processing skill component most involved in the solution to the metalinguistic problem.

There are several implications of these results. First, the study provides further support for the theoretical distinction between analysis of linguistic knowledge and control of processing. Problems considered as tests of each of these were treated differently by the children as a function of their level of bilingualism. But even if the task analysis is rejected, and the argument that mastery of analysis of knowledge and control of processing differentially underlie the solution to these tasks is not accepted, the results still show that these tasks are not the same. In that case, it would still be necessary to develop some other description of the essential difference between these tasks.

Second, the study points to the need for more detailed descriptions of linguistic awareness. There is no single ability that stands as a measure of this construct. In the present approach, two skill components are considered, but there are undoubtedly others as well, and each metalinguistic task is somewhat unique in its processing demands. By dividing metalinguistic tasks simply on the basis of the two skill components used here, it is possible to obtain reasonably systematic results that relate this performance to levels of bilingualism.

Investigations of linguistic awareness must continue to increase the precision with which the construct is defined.

Finally, the influence of bilingualism on the development of linguistic awareness not only helps to clarify this specific relation but also has implications for other cognitive skills that have been considered in studies of bilingualism. As was predicted from earlier studies, the level of bilingualism is decisive in determining the effect it will have on development. Minimally, one must consider the extent to which the child knows a second language, the uses for which that language is employed, and possibly the social context surrounding its use, before predictions about its effect on the child's cognitive development can be made. Further research must examine these factors more carefully, possibly using longitudinal study, and certainly developing more rigorous methods for definition and measurement of the relevant factors.

Notes

[1]A fuller explanation of how these metalinguistic problems differ in their demands for analysis and control is provided elsewhere (Bialystok & Ryan, 1985). A detailed task analysis for grammaticality judgment problems is provided in Bialystok, 1986b.

[2]Since these children were in Grade 1, their reading ability in *any* language was limited.

[3]Winer (1971) argues that the distribution of variance for proportion scores is skewed and should be corrected by arcsine transformation prior to applying statistical analyses. The arcsine transformation converts the scores to radians, numerically expressed as scores out of 3.14.

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Table 1

Mean score per group on language and metalinguistic tasks.

Group:	Monolingual	Partially Bilingual	Fully Bilingual	
N	20	20	17	
Task	Mean (sd)	Mean (sd)	Mean (sd)	Differences
Language Proficiency				
PPVT:				
English	97.30 (14.14)	87.10 (9.59)	84.94 (12.73)	M > P,F
French	--	40.05 (10.56)	70.94 (13.51)	P < F
Control of Processing				
Arbitrariness: (Out of 6.28)				
Sun/moon	2.51 (2.41)	4.24 (2.55)	4.25 (1.54)	M < P,F
Dog/cat	3.76 (1.28)	3.45 (0.97)	4.06 (1.47)	--
Analysis of Knowledge				
Word Concept: (Out of 3.14)				
Judge	1.41 (1.06)	1.73 (1.20)	2.40 (1.37)	--
Define	1.09 (1.25)	1.41 (1.00)	2.12 (0.95)	M < F
Syntax: (Out of 12)				
	7.15 (2.08)	7.25 (3.09)	9.94 (1.95)	M,P < F